(FILE 'USPAT' ENTERED AT 12:30:58 ON 19 AUG 1999)

L1	3	S USB(15A)WIRELESS
L2	3	FOCUS L1 1-
L3	7	S USB(30A)WIRELESS
L4	4	S L3 NOT L1
L5	4	FOCUS L4 1-

US PAT NO: 5,890,015 [IMAGE AVAILABLE] L2: 1 of 3
TITLE: Method and apparatus for implementing a wireless universal serial bus host controller by interfacing a universal serial bus hub as a universal serial bus device

ABSTRACT:
A Universal Serial Bus (USB) system is disclosed. The USB system includes a first host controller. A hub is coupled to the first host controller. A second host controller interfaces with the hub as a **USB** device. In one embodiment of the **USB** system, the second host controller is a **wireless** host controller. The second host controller includes a wireless system side module coupled to the hub and a wireless remote module containing host controller circuitry that receives signals from the **wireless** system side module. A method for interfacing a hub to a **USB** system is disclosed. A hub is coupled to a first host controller. The first host controller is coupled to a second hub connected to a second host controller that resides inside the computer.

SUMMARY:

BSUM(2)

The present invention pertains to the field of wireless, remote peripherals for computer systems. More specifically, the present invention relates to an apparatus and method for configuring a **wireless** module onto a Universal Serial Bus (**USB**) system for attaching **USB** devices.

SUMMARY:

BSUM(6)

The round trip response time delay requirements for **USB** systems make it difficult to implement a **wireless** link for configuring a **wireless** module onto a **USB** system. Additional time is required for transforming wire data through a transceiver to **wireless** data, transmitting the wireless data between a system side module and a remote module, and transforming the wireless data back to wire data. Current technologies for transmitting wireless signals such as infrared signals, radio signals, ultrasonic wave signals, and other aerial propagation signals do not provide the adequate bandwidth for transmitting data signals on the USB while complying with the round trip response time delay requirement.

SUMMARY:

BSUM(7)

Thus, what is needed is a method and apparatus for configuring a **wireless** module for connecting **USB** devices onto a **USB** system implementing the current technologies for transmitting **wireless** signals.

SUMMARY:

BSUM(9)

A Universal Serial Bus (USB) system is disclosed. The USB system includes a first host controller. A hub is coupled to the first host

controller. A second host controller interfaces with the hub as a **USB** device. In one embodiment of the **USB** system, the second host controller is a **wireless** host controller. The second host controller includes a wireless system side module coupled to the hub and a wireless remote module containing host controller circuitry that receives signals from the wireless system side module.

SUMMARY:

BSUM(10)

A USB system is disclosed. The USB system includes a host residing inside a computer housing. A first host controller resides outside of the computer housing. In one embodiment of the **USB** system, the first host controller communicates with the host via a **wireless** communication system.

DETDESC:

DETD(8)

The present invention is related to the use of the **USB** host 200 to configure a **wireless** module onto the **USB** for connecting **USB** devices. According to one embodiment, configuring a **wireless** module is performed by **USB** host 200 in response to the processor 201 executing sequences of instructions contained in the memory 213. Such instructions may be read into the memory 213 from other computer-readable mediums such as data storage device 231. Execution of the sequences of instructions contained in the memory 213 causes the processor to configure a wireless module, as will be described hereafter. In alternative embodiments, hard-wired circuitry may be used in place of or in combination with software instructions to implement the present invention. Thus, the present invention is not limited to any specific combination of hardware circuitry and software.

DETDESC:

DETD(13)

FIG. 4 illustrates a block diagram of a **USB** system 400 configured with a **wireless** module according to one embodiment of the present invention. A second host controller 420 interfaces the USB host 200 as a USB device via hub 250 and **USB** connections 245 and 410. The second host controller 420 comprises a **wireless** system side module 421 and a wireless remote module 422. The **wireless** system side module 421 is connected to the hub 250 via **USB** 410. According to one embodiment of the present invention, the USB host 200 including the host controller 240 reside inside a computer housing. The hub 250 and the second host controller 420 reside outside of the computer housing.

DETDESC:

DETD(14)

FIG. 5 illustrates one embodiment of the wireless system side module 421 according to the present invention. The **wireless** system side module 421 includes a serial interface engine (SIE) 510 that interfaces with the **USB** 410. The SIE 510 receives transmitted data from the **USB** host 200 and checks the data for errors. The **wireless** system side module 421 includes a transceiver unit 530. The transceiver unit 530 operates to transmit and receive data to and from a transceiver unit in wireless remote module 422. The wireless system side module 421 includes a microcontroller 520 coupled to the SIE 510 and the transceiver unit 530. The microcontroller 520 receives the data from the SIE 510 and the transceiver unit 530 and determines the direction to send the data. Upon receiving a transmission from the USB host 200, the microcontroller 520

sends an acknowledgment back to the USB host 200 via the SIE 510. The SIE 510, microcontroller 520, and transceiver unit 530 may be implemented by any known circuitry.

DETDESC:

DETD(15)

FIG. 6 illustrates one embodiment of the wireless remote module 422 according to the present invention. The wireless remote module 422 includes a transceiver unit 610. The transceiver unit 610 operates to transmit and receive data to and from a transceiver unit 530 in wireless system side module 421. The **wireless** remote module 422 includes host controller circuitry 630 that connects to the **USB** 430. The host controller circuitry 630 operates similarly to the circuitry in host controller 240 and allows the wireless remote module 422 to operate as a host controller. The wireless remote module 422 includes a microcontroller 640 coupled to the transceiver unit 610 and the host controller circuitry 630. The microcontroller 640 receives data from the transceiver unit 610 and the host controller circuitry 630 and determines the direction to send the data. The wireless remote module 422 also includes a memory 620. The memory 620 operates to store data received by the host controller circuitry 630 when the microcontroller is busy until the microcontroller 640 is ready to process the data. The transceiver unit 610, memory 620, host controller circuitry 630, and microcontroller 640 may be implemented by any known circuitry.

DETDESC:

DETD(16)

Referring back to FIG. 4, the wireless system side module 421 and the **wireless** remote module 422 provides a **wireless** second host controller that allows additional **USB** devices to communicate with the **USB** host 200. As shown, a USB hub 431 is coupled to the second host controller 420 via USB 430. The USB hub 431 is coupled to a USB device 441 via USB 440. According to the embodiment of the present invention shown in FIG. 4, users can connect peripherals such as a video monitor and input/output devices to a computer system at a remote location without having to directly connect the peripherals to the computer system using cables.

DETDESC:

DETD(17)

The configuration of the host controller 420 in FIG. 4 bounds the interpacket wire transmissions on the **USB** system 400 with the round trip response time delay requirement but not the **wireless** transmissions. The round trip response time delay requirement applies to transmissions between a host controller and the end device on the USB. Thus, the round trip response time delay requirement applies to transmissions between the host controller 240 and the **wireless** system side module 421 and transmissions between the **wireless** remote module 422 and the **USB** component 441. These transmissions are performed on a homogenous wire medium and may be completed at the bandwidth and rate required by the USB specification.

DETDESC:

DETD(20)

By configuring a custom host controller driver for the second host controller 420 that presents the **wireless** remote module 422 as if it was directly attached to the **USB** host 200, the second host controller 420 appears to the host 200 as a non-**wireless USB** host

controller. FIG. 8 is a block diagram illustrating how the second host controller 420 appears to the host 200 from a data flow perspective. This allows the existing device drivers for **USB** devices at the remote hub to be preserved without requiring any special handling for supporting **wireless USB** devices.

DETDESC:

DETD(21)

In one embodiment of the present invention, the **wireless** system side module 421 makes use of **USB** defmed isochronous data pipes to provide low latency communication with the **wireless** remote module 422. The interactions between the **USB** host 200 and the **wireless** remote module 422 involve interchanging basic **USB** host controller information such as frame size adjustments, data for remote devices, and control/status information about existing and newly attached and detached remote USB peripherals.

CLAIMS:

CLMS(1)

What is claimed is:

1. A Universal Serial Bus (**USB**) system, comprising:
a first host controller;
a hub coupled to the first host controller;
a **wireless** host controller interfacing the hub as a **USB** device that includes a **wireless** system side module coupled to the hub, and
a **wireless** remote module containing host controller circuitry that receives signals from the wireless system side module.

CLAIMS:

CLMS(2)

2. The **USB** system of claim 1, further comprising a second hub coupled to the **wireless** host controller.

CLAIMS:

CLMS(5)

5. The **USB** system of claim 4, further comprising a **wireless** host controller driver that manages the **wireless** host controller, wherein the **wireless** host controller driver interfaces with the **wireless** host controller via the **USB** driver, the first host controller driver, the first host controller, and the hub.

CLAIMS:

CLMS(6)

6. A Universal Serial Bus System (USB), comprising:
a USB host residing inside a computer housing; and
a first host controller residing outside the computer housing that communicates with the **USB** host via a **wireless** communication system;
a second host controller;
a hub coupled to the second host controller;
a **wireless** system side module coupled to the hub that interfaces with the hub as a **USB** device; and
a **wireless** remote module that receives signals from the **wireless** system side module and that contains host controller circuitry.

CLAIMS:

CLMS(10)

10. A computer system comprising:
a bus;
a processor coupled to the bus;
a memory coupled to the bus;
a first host controller coupled to the bus;
a hub coupled to the first host controller; and
a **wireless** host controller, interfacing with the hub as a Universal Serial Bus (**USB**) device, that includes a **wireless** system side module coupled to the hub, and a **wireless** remote module containing host controller circuitry that receives signals from the wireless system side module.

CLAIMS:

CLMS(14)

14. The system of claim 13, further comprising a wireless host controller driver that manages the wireless host controller, wherein the **wireless** host controller driver interfaces with the **wireless** host controller via the **USB** driver, the first host controller driver, the first host controller, and the hub.

US PAT NO: 5,909,559 [IMAGE AVAILABLE] L2: 2 of 3
TITLE: Bus bridge device including data bus of first width for a first processor, memory controller, arbiter circuit and second processor having a different second data width

DETDESC:

DETD(1409)

A chip 8520 integrates on a single chip a wrapper/DSP coupled to PCI bus 330 and dedicated to virtualizing networking comm, V.34bis modem, xDSL modem, **wireless** modem to RF interface, DSVD, **USB** and/or Star-express connectivity, LAN/WAN by WAN, Texas Instruments ThunderLAN(R), and USB smart hub operations.

US PAT NO: 5,862,452 [IMAGE AVAILABLE] L2: 3 of 3
TITLE: Method, access point device and peripheral devices for low complexity dynamic persistence mode for random access in a wireless communication system

DETDESC:

DETD(41)

The Wireless Access Point (1006) or simply access point manages the communication link, coordinating the transmission of all wireless peripherals and providing access to both the computational resources and the network. The access point connects to the computational resource over the C-Interface. This C-Interface may take the forms of a **USB**, PCI, ISA, or Device Bay. Alternatively, the C-Interface may be maintained over the **wireless** A-Interface to wirelessly connected computer. In either case, the access point manages access to the computational resource and is aware of all available applications. In addition, the access point may also maintain a connection to wired voice & data network over the N-interface. The N-Interface may take on the forms of a POTS modem, ADSL, ISDN, or Cable.

US PAT NO: 5,926,208 [IMAGE AVAILABLE] L5: 2 of 4
TITLE: Video compression and decompression arrangement having reconfigurable camera and low-bandwidth transmission capability

DETDESC:

DETD(92)

Many different formats of compressed data, such as MPEG, MPEG1, MPEG2, JPEG, H.263, H.261, and Fractal, may be transmitted across the **USB** to the computer system 1002. Alternatively, the interface link 1006 may be a parallel interface bus, a P1394 interface cable, or a **wireless** infrared connection. One skilled in the art will recognize that other types of interface links may be used. The interface bandwidth need only exceed the compression module bandwidth requirements. Since the bandwidth of the audio and video data is being reduced before transmission across the interface link, low cost and commonly available interfaces may be used.

US PAT NO: 5,787,259 [IMAGE AVAILABLE] L5: 4 of 4
TITLE: Digital interconnects of a PC with consumer electronics devices

DETDESC:

DETD(7)

A keyboard 60 and a mouse 65 provide user commands to EC 15. The keyboard 60 and the mouse 65 are connected to a first transmitter/receiver hub 70 that communicates with a second hub 75 using infrared or radio frequency signals. The second hub 75 is connected to EC 15 by a bus 80 that typically employs the **USB** protocol. A modem 85 is also connected to the bus 80 to provide EC 15 with access to an external telephone line. Hubs 70, 75 provide a **wireless** connection between the input devices and the bus 80. This permits the keyboard and mouse to be placed remotely from the EC 15. If such a wireless connection were unnecessary, then the keyboard and the mouse could be connected directly to the bus 80.